

# Respiratory tract infection: pneumonia / د. شذى كاظم عطره / م. ثالث ت. تخدير / 2023-2024

## Introduction

Patients with respiratory disease have **an increased chance** of developing complications “**perioperatively**”. Most problems are seen” **postoperatively** “ and are usually: (i) secondary to shallow breathing, (ii) poor lung expansion, (iii) basal lung collapse and (iv) subsequent infection.

To minimize the risk of complications these patients should be (a) **identified preoperatively** and (b) **their pulmonary function optimized**.

**This involves** (1) physiotherapy, (2) a review of all medications and may **require** the help of a respiratory physician.

**Elective surgery** is **postponed** until the patient is ready. In the general surgical population **thoracic** and **upper abdominal procedures** are **associated** with the **highest risk (10-40%)** of **pulmonary complications**. The **benefits** of the proposed surgery **must therefore be weighed** against the **risks** involved.

## Quizzes

How does general anaesthesia affect respiratory function?

General anaesthesia has **significant effects** on the; (a) **mechanics of the respiratory system**, (b) **It alters the functional residual capacity (FRC)**, (3) **respiratory muscle function**, (4) **the shape and motion of the lungs and chest wall**, and (5) **it may affect the diameter of the airways**.

Can you go under anesthesia with respiratory infection?

While it's possible in some cases to go under anesthesia with a slight runny nose or mild cold, **if** you have more intense symptoms — severe cough, sinus infection, or fever — doctors may **suggest** waiting on the procedure.

Do antibiotics affect anesthesia?

Additionally, antibiotics can **interact** with anesthetic drugs in a variety of ways, with the **most severe interactions resulting in organ toxicity**. According to a paper, **most antibiotics can cause neuromuscular blockade** alone and can also **potentiate blockade** when combined with **neuromuscular blockers**.

What anesthesia is used for respiratory disease?

Anaesthetic Drugs

**Ketamine** : (a) preserves respiratory drive and is better at maintaining the airway, (b) although secretions increase.

**Thiopentone** () increases airway reactivity.

**Volatile anaesthetics** () depress respiratory drive in decreasing order as follows: Enflurane>Desflurane>Isoflurane>Sevoflurane>Halothane.

What is the mechanism of the respiratory system in response to anesthesia?

**Hypoxic pulmonary vasoconstriction**, an important safety mechanism, is **inhibited** by majority of the anaesthetic drugs. **Ventilation perfusion mismatch leads to reduced arterial oxygen concentration** mainly **because of early closure of airway, thus leading to decreased ventilation and atelectasis during anaesthesia**.

How can you optimize your lung health?

**Regular respiratory exercise** will help you avoid deconditioning, which is where your breathing muscles get **weaker** with **inactivity**, but will also give you the best chance of coping with a lung infection.

What is the respiratory rate during anesthesia?

Normally rates of **8-12 bpm** are adequate under anesthesia as long as **appropriate tidal volumes** are selected. Remember that **slow, deep breaths** are **usually more beneficial for alveolar ventilation**.

## Respiratory Infections

Respiratory tract infections (RTIs) are infections of parts of the body involved in **breathing**, such as the \*sinuses, \*throat, \*airways or \*lungs. Most RTIs get better without treatment, but sometimes you may need to see a GP.

**Infectious diseases** are caused by **germs** (viruses, bacteria or other pathogenic microbes). Germs that can infect the respiratory system are frequently spread through **mucus and saliva** (also known as "respiratory secretions") when a person **coughs, sneezes, talks or laughs**.

**Upper respiratory infection** is more common than **lower respiratory infection**.

### Symptoms of an RTI include:

- 1) a cough – you may bring up mucus (phlegm)
- 2) sneezing
- 3) a stuffy or runny nose
- 4) a sore throat
- 5) headaches
- 6) muscle aches
- 7) breathlessness, tight chest or wheezing
- 8) a high temperature
- 9) feeling generally unwell

Most RTIs pass within 1 to 2 weeks. You can usually treat your symptoms at home.

## A pharmacist can help with an RTI

A pharmacist can suggest treatments to help relieve your symptoms, such as **decongestants** and **nasal sprays**.

You can also buy **cough medicines** and **throat lozenges** معينات, although there's little evidence to show they help.

Some treatments contain **paracetamol** and **ibuprofen**.

If you're taking these medicines separately, be careful **not to take more than the recommended dose**.

Certain treatments are **not suitable** for **children, babies** and **pregnant** women.

### Treatment will depend on the cause of your RTI:

- a **virus** (like **colds**) – this usually **clears up by itself** after a **few weeks** and **antibiotics will not help**
- **bacteria** (like **pneumonia**) – a GP may prescribe **antibiotics** (make sure you complete the whole course as advised by a GP, even if you start to feel better). **Antibiotics** are only used to treat bacterial infections. They're not used for treating viral infections because they do not work for this type of infection.

Sometimes a **sample of your mucus** may need to be tested to see what's causing your RTI.

### Difference between upper RTIs and lower RTIs

Upper RTIs (sinuses and throat)	Lower RTIs (airways and lungs)
<a href="#">Common cold</a>	<a href="#">Bronchitis</a>
<a href="#">Sinusitis (sinus infection)</a>	<a href="#">Bronchiolitis</a>
<a href="#">Tonsillitis</a>	<a href="#">Chest infection</a>
<a href="#">Laryngitis</a>	<a href="#">Pneumonia (lung infection)</a>

**Flu** can be an upper or lower RTI.

**Lower RTIs** tend to **last longer** and can be **more serious**.

**Respiratory viruses** can also cause the **common cold**. Certain respiratory viruses of interest are respiratory syncytial virus (RSV), rhinovirus, enterovirus, coronaviruses (including SARS and MERS CoV), adenoviruses, and parainfluenza viruses.

**A bacterial respiratory tract infection** is an infection of the **sinuses, throat, airway, or lungs**. Bacterial infections may develop **after having a viral illness** like a cold or the flu. **Symptoms** tend to **localize to one particular area**. So how do you know **if your common cold** has morphed **into a bacterial respiratory tract infection**? Here are some warning signs and treatment options that'll help you feel better in no time.

## Bacterial vs. Viral Infections

The difference between bacterial and viral infections is simple: bacterial infections are caused by **bacteria** (single-celled microorganisms), while viral infections are caused by **viruses** (smaller than bacteria and require a living host to multiply).

Many ailments and illnesses have similar symptoms whether they are viral or bacterial—the **biggest difference between the two types of infections is that bacterial infections can be treated with antibiotics**, while viral infections **cannot**.

### **Bacterial Respiratory Tract Infection Symptoms**

Respiratory bacterial infections can affect two areas of your body: the upper respiratory system, and the lower respiratory system.

Generally, there are two groups of respiratory infections:

- **Upper respiratory tract infections (URTIs).** These infections affect the nose, throat and sinuses.
- **Lower respiratory tract infections (LRTIs).** These infections occur in the airways and the lungs.

### **Upper Respiratory Tract Infection Types and Symptoms**

- 1) Common cold
- 2) Stuffy, runny nose
- 3) Sneezing
- 4) Low-grade fever

A few **warning signs** that your cold has progressed from a viral infection to a bacterial infection are:

- 1) Symptoms lasting longer **than 10–14 days**
- 2) A fever higher **than 100.4 degrees**
- 3) A fever that **gets worse** a couple of days into the illness, rather than getting better
- 4) White **pus-filled spots on the tonsils**

### **Sinusitis**

Sinusitis is inflammation of the sinuses. **Symptoms** include:

- 1) Postnasal drip
- 2) Stuffy nose/congestion
- 3) Tooth pain
- 4) Coughing
- 5) Greenish nasal discharge
- 6) Facial tenderness (specifically under the eyes or at the bridge of the nose)
- 7) Bad breath
- 8) Fatigue
- 9) Fever

### **Pharyngitis**

Pharyngitis is characterized as inflammation of the pharynx, which is located in the back of the throat. It's more commonly known as a "sore throat." **Symptoms** include:

- 1) Sneezing
- 2) Headache
- 3) Runny nose
- 4) Cough
- 5) Body aches
- 6) Fatigue
- 7) Chills
- 8) Low-grade fever

### **Epiglottitis:**

This is when the **epiglottis**—the flap at the base of your tongue that prevents food from entering the windpipe—becomes inflamed. **Symptoms** are typically rapid and include:

- 1) Shortness of breath
- 2) Sore throat
- 3) Pain/difficulty swallowing
- 4) Fever
- 5) Coughing
- 6) Drooling
- 7) Swollen lymph nodes
- 8) Laryngotracheitis

**Laryngotracheitis** is an infection of the **upper airway** that **blocks breathing** and has a distinctive “barking” cough. This infection is more commonly known as “COUP.” **Symptoms** include:

- 1) “Barking” cough
- 2) Difficulty breathing
- 3) Fast or noisy breathing
- 4) Wheezing
- 5) Shortness of breath
- 6) Fatigue
- 7) Fever
- 8) Congestion/runny nose
- 9) Vocal hoarseness

## Lower Respiratory Tract Infection Types and Symptoms

### Bronchitis

Bronchitis is a bronchial tube inflammation. Bronchial tubes carry air to your lungs. Bronchitis **symptoms** include:

- 1) Coughing that produces thickened mucus
- 2) Shortness of breath
- 3) Fatigue
- 4) Overall feeling of malaise
- 5) Runny nose or postnasal drip
- 6) Headache
- 7) Sore throat
- 8) Pressure in the chest

### Bronchiolitis

Bronchiolitis may sound similar to bronchitis, but they are two distinct lung infections. Bronchitis causes inflammation in the upper bronchial tubes and trachea, while bronchiolitis causes swelling in the smallest lung airways—called bronchioles. In addition, bronchiolitis is more common in younger children, mostly under the age of 2. **Symptoms** include:

- 1) Dry, raspy cough
- 2) Wheezing
- 3) Difficulty feeding (infants) or eating (toddlers)
- 4) Low-grade fever
- 5) Runny or stuffy nose

### Pneumonia

Pneumonia is the most common bacterial lower respiratory infection. It’s an infection that inflames air sacs in one or both **lungs**—these air sacs may fill with fluid or pus. Pneumonia **symptoms** include:

- 1) Cough that produces phlegm or pus

- 2) Fever
- 3) Chills
- 4) Difficulty breathing
- 5) Sharp chest pain
- 6) Dehydration
- 7) Fatigue
- 8) Loss of appetite
- 9) Clammy skin or sweating
- 10) Fast breathing
- 11) Shallow breathing
- 12) Shortness of breath
- 13) Wheezing
- 14) Rapid heart rate

Please note that many of these bacterial respiratory infections have similar symptoms. Many of these infections can be serious if left untreated. Unlike a viral illness that has to “run its course,” bacterial infections must be treated with antibiotics.

## Bacterial Respiratory Tract Infection Diagnosis

If a respiratory tract infection is suspected, your doctor may perform the following **tests** to provide the best diagnosis and treatment plan possible:

- 1) **Throat swab**: your physician will take a sterile cotton swab and swipe it across the back of your throat. The swab will collect a sample of secretions that are being produced in the back of your throat. They will then be tested in a lab to determine whether you have a bacterial infection in your throat.
- 2) **Lateral neck x-ray**: your doctor may order a lateral neck x-ray to rule out epiglottitis, especially if you’ve been having difficulty breathing.
- 3) **Chest x-ray**: if pneumonia is suspected, your doctor may order a chest x-ray.
- 4) **Bronchoscope**.
- 5) **CT scan**: CT scans are often used to diagnose sinusitis & its complication, pneumonia & its complication, & involvement of lymphadenopathy & exclude malignancy.

## Bacterial Respiratory Tract Infection Treatments

When a bacterial respiratory tract infection occurs, your doctor will probably prescribe an\* **antibiotic** to clear the infection. To help \***alleviate symptoms and bring relief**, many doctors suggest using:

- 1) Cough suppressants
- 2) Expectorants (medication that promotes the secretion of sputum/mucus)
- 3) Vitamin C and zinc to reduce symptoms
- 4) Steam inhalation
- 5) Gargling salt water الغرغرة بالمياه المالحة
- 6) Pain relievers

### Q/ define bacterial respiratory infection?

A bacterial respiratory tract infection is an infection of the sinuses, throat, airway, or lungs. Antibiotics for bacterial infection: Amoxicillin (50 mg/kg/day) alone or with clavulanate is the first choice in moderate and severe presentation respectively. Alternative initial antibiotics include cefaclor (40-50 mg/kg/day) and cefuroxime-axetil (30 mg/kg/day) or cefpodoxima-proxetil (8 mg/kg/day) respectively.

### Complications of a respiratory infection may include:

- **Empyema**. Empyema is a collection of pus beside the lungs, caused by a bacterial infection that can lead to life-threatening problems such as sepsis (bacteria in the blood) and shock. Symptoms include fever, cough, shortness of breath and chest pain.

- **Lung abscess.** A lung abscess is a pus-filled cavity in the lung surrounded by inflamed tissue. It is usually caused by a severe infection such as **pneumonia** or **tuberculosis** or from inhaling material into the lungs from the mouth.
- **Potts puffy tumor.** This is an uncommon complication of sinusitis (a type of upper respiratory tract infection that causes inflammation of the sinus cavities in the skull). It is an abscess of the forehead area with frontal swelling. Potts puffy tumor is usually seen in late childhood or adolescence. Symptoms include red, tender swelling in the mid-forehead, headache and fever.
- **Orbital cellulitis.** Orbital cellulitis is another possible complication of sinusitis. This is an infection of the tissue within the eye socket and around the eye. Symptoms include pain, swelling, red eye, fever, a bulging eye, impaired vision and impaired eye movements.
- **Orbital abscess.** Also a further complication of sinusitis causing orbital cellulitis, orbital abscess is a collection of bacteria and pus behind the eye. Symptoms include eye pain, bulging of the eye, redness of the eye, changes in vision and fever.
- **Mastoiditis.** Mastoiditis is a complication of otitis (a type of upper respiratory tract infection that causes inflammation and possible infection of the middle ear). This is a serious bacterial infection that affects the mastoid bone behind the ear. Symptoms may include ear pain, fever, headache, drainage from the infected ear, redness, swelling and tenderness in the affected ear.

Lower respiratory tract infections differ from upper respiratory tract infections by the area of the respiratory tract they affect.

While lower respiratory tract infections involve the airways below the larynx, upper respiratory tract infections occur in the structures in the larynx or above.

People who have lower respiratory tract infections will experience coughing as the primary symptom.

People with upper respiratory tract infections will feel the symptoms mainly above the neck, such as sneezing, headaches, and sore throats. They may also experience body aches, especially if they have a fever.

Complications of lower respiratory tract infections can include:

- 1) congestive heart failure
- 2) respiratory failure
- 3) respiratory arrest
- 4) sepsis, which is a blood infection that can lead to organ shutdown
- 5) lung abscesses

## General considerations

**General health status** The American Society of Anesthesiologists classification (1 to 5) correlates well with the risk of post-operative pulmonary complications. **Poor exercise tolerance** also predicts those at risk.

### Smoking

Active and passive smokers have **hyper-reactive airways** with **poor muco-ciliary clearance** of secretions. They are at **increased risk of perioperative respiratory complications**, such as **atelectasis** or **pneumonia**. It takes 8 weeks abstinence for this risk to diminish. Even abstinence for the 12 hours before anaesthesia will allow time for clearance of nicotine, a **coronary vasoconstrictor**, and a **fall in the levels of carboxyhaemoglobin** thus improving oxygen carriage in the blood.

### Obesity

The normal range for BMI (Body Mass Index - defined as weight (Kg) divided by the square of the height (m) is 22-28. Over 35 is morbidly obese. Normal weight (Kg) is height (cm) minus 100 for males, or height minus 105 for females. Obese patients may present a **difficult intubation** and have **perioperative basal lung collapse** leading to **postoperative hypoxia**.

A history of sleep apnoea may lead to post-operative airway compromise. If practical obese patients should lose weight preoperatively, and co-existent diabetes and hypertension stabilized.

## Physiotherapy

Teaching patients in the preoperative period to participate with techniques to mobilize secretions and increase lung volumes in the postoperative period will **reduce pulmonary complications**. Methods employed are \*early mobilization, \*coughing, \*deep breathing, \*chest percussion and vibration together with postural drainage.

## Pain

Relief Effective analgesia is important as it allows deep breathing and coughing and mobilization. This helps prevent secretion retention and lung collapse, and reduces the incidence of postoperative pneumonia.

Epidurals appear particularly good at this for abdominal and thoracic surgical procedures, although they are not available everywhere. The method of postoperative analgesia should always be discussed with the patient before surgery.

Postoperative pulmonary complication can be broadly defined as conditions affecting the respiratory tract that can adversely influence the clinical course of a patient after surgery.

Post-operative pulmonary complications are the most frequent reported cause of morbidity and mortality in hospitals.

The occurrence of postoperative pulmonary complications in the world is between 5 and 80% with variation attributed to set-up, preoperative and intra-operative risk factors.

The incidence of postoperative pulmonary complication was 21.7% in the study area. Postoperative pulmonary complications can be associated with patient-related and procedure related risk factors.

Prevention of postoperative pulmonary complication **requires** comprehensive multidisciplinary approach that includes preoperative risk stratification and optimizations.

Screening and identification of patients at high risk for post-operative pulmonary complications are vital during preoperative period. Patients in high risk group should receive pulmonary complication prevention and intervention protocol such as: a) cessation from smoking, b) preoperative inspiratory muscle training, c) goal-directed fluid therapy, d) chest physiotherapy, e) postoperative analgesia especially neuro-axial block, f) early mobilization and g) early oral intake.

## What are the risk factors for perioperative pulmonary complications?

Studies showed that the **risk of postoperative pulmonary complications** can be patient-related risk factors such as, chronic pulmonary disease, age older than 60 years, ASA  $\geq$  II ([Statement on ASA Physical Status Classification System; American Society of Anesthesiologists \(ASA\)](#)), smoking history, functional dependence, obstructive sleep apnea, cardiovascular problem, malnutrition or procedure related risk factors.

### What does ASA Class II mean?

**ASA 2:** A patient with mild systemic disease. Example: Patient with no functional limitations and a well-controlled disease (e.g., treated hypertension, obesity with BMI under 35, frequent social drinker, or cigarette smoker). **ASA 3:** A patient with a severe systemic disease that is not life-threatening.

### What is the risk for respiratory complications after surgery?

**Pulmonary complications** are a major cause of **morbidity** and **mortality** during the postoperative period [1]. The reported incidence of postoperative pulmonary complications ranges from 5 to 80 percent, depending upon the **patient** population and the **criteria** used to define a complication.

## Effects of General Anaesthesia

These are relatively minor and do not persist beyond 24 hours. However, they may tip a patient with **limited respiratory reserve** into **respiratory failure**.

- 1) • Manipulation of the airway (laryngoscopy and intubation) and surgical stimulation may precipitate laryngeal or bronchial **spasm**.
- 2) • Endotracheal intubation bypasses the filtering, humidifying and warming functions of the upper airway **allowing the entry of pathogens** and the **drying of secretions**. Adequate humidification and warming of the anesthetic gases with a Heat and Moisture Exchanger (HME) is ideal.
- 3) • **Volatile anesthetic** agents i) **depress** “the **respiratory response** to hypoxia and hypercapnia”, and ii) “the ability to **clear secretions** is **reduced**”. iii) “**Functional residual capacity (FRC)** decreases” and iv) “pulmonary shunt increases”; these are unfavorable changes **leading to** “**hypoxia**” and occur especially in \*lithotomy and \*head-down positions, and in the \*obese.
- 4) • **Intermittent positive pressure ventilation** **causes** an imbalance in ventilation and perfusion matching in the lung, and **necessitates** an increase in the inspired oxygen concentration.
- 5) • **Excessive fluid therapy** **can result** in pulmonary oedema in patients with cardiac failure.
- 6) • **Neuromuscular blockade** is **reversed** **عكس** before extubation. In the recovery room **residual effects of anaesthesia** depress upper airway muscular tone, and airway obstruction may occur.

## Anaesthetic drugs

- 1) • The **intravenous induction agents** thiopentone, propofol and etomidate **produce an initial transient apnea**. Ketamine **preserves respiratory drive** and **is better at maintaining the airway**, although **secretions increase**.
- 2) • Thiopentone **increases airway reactivity**.
- 3) • **Volatile anaesthetics depress respiratory drive in decreasing order as follows:**  
Enflurane>Desflurane>Isoflurane> Sevoflurane>Halothane. Ether however stimulates respiratory drive and increases minute ventilation. It is, however, **irritant to the airway**, **stimulates saliva production** and may **induce coughing**.
- 4) • Atracurium and tubocurare **release histamine** and **may result in bronchospasm**. They are **best avoided** in **asthma**.
- 5) • Opioid drugs and benzodiazepines **depress \*respiratory drive** and **\*response to hypoxia** and **hypercapnia**. Morphine may result in histamine release and occasionally bronchospasm. Nonsteroidal anti-inflammatory drugs (NSAIDS) may **exacerbate asthma**. Pethidine is a **useful alternative analgesic for asthmatics**.

## Effects of Surgery

- 1) • To immobilize **upper abdominal and thoracic incisions** and **limit pain**, patients splint **these areas postoperatively with their intercostal and diaphragmatic muscles**. **This limits their ability** to take **deep breaths** and **increases the risk of postoperative pulmonary complications**. Surgery on the limbs, lower abdomen or body surface surgery has **less effect**.
- 2) • A **laparotomy** may remove fluid or masses that cause **diaphragmatic splinting and respiratory difficulty**. However, **gas** (especially nitrous oxide) and **fluid** may **accumulate** within the bowel and peritoneal cavity **exacerbating** post-operative distension and splinting.
- 3) • Surgery **lasting more than 3 hours** is **associated** with a **higher risk of pulmonary complications**.
- 4) • Postoperatively, return of lung function to normal **may take one to two weeks**.

## Preoperative preparation

### General assessment

This involves **\*history, \*examination and \*investigation**.

**History.** **Ask** about **symptoms** of wheeze, cough, sputum production, haemoptysis, chest pain, exercise tolerance, orthopnoea and paroxysmal nocturnal dyspnoea. **The diagnosis of chronic chest complaints** such as asthma or bronchiectasis is often known.

**Present medication and allergies** are noted, and a **history of smoking** sought.

**Previous anaesthetic records** may be available and can help in planning care.

**Examination.** **Inspect** for *\*cyanosis*, *\*dyspnoea*, *\*respiratory rate*, *\*asymmetry of chest wall movement*, *\*scars*, *\*cough* and *\*sputum colour*.

**Percussion** and **auscultation** of chest may suggest areas of *\*collapse* and *\*consolidation*, *\*pleural effusions*, *\*pulmonary oedema* or *\*infection*.

**Cor pulmonale** may be evident as *\*peripheral oedema* and *\*raised jugular venous pressure*. A **bounding pulse** and **hand flap** may indicate **carbon dioxide retention**, and **enlarged lymph nodes in the neck** may suggest **lung cancer**.

**Investigations.** **Leukocytosis** may indicate **active infection**, and **polycythemia** **chronic hypoxemia**. **Arterial blood gases** should be performed in patients who **are dyspnoeic with minimal exertion** and the results interpreted in relation to the inspired oxygen concentration.

**Preoperative hypoxia** or **carbon dioxide retention** indicates the possibility of postoperative respiratory failure which **may require a period of assisted ventilation on the Intensive Care Unit**.

**Pulmonary function tests**, if available, **provide** baseline pre-operative measurements. **The chest clinic** will have charts to compare these results against those predicted for the patients age, sex and weight. **The results** are also **compared** against the patient's previous records to assess current disease control.

● **FEV1.0 (Forced Expiratory Volume in 1 second)** and **FVC (Forced Vital Capacity)** are commonly measured. **A reduction** in the **FEV1.0:FVC ratio** indicates **\*obstructive airways disease**. (The normal is 0.75 (75%) or more). A reduction in FVC occurs in "**restrictive lung disease**".

● **An FEV1.0 or FVC less than 70%** of predicted, or **an FEV1.0:FVC ratio** less than 65%, is **associated with** an **increased risk of pulmonary complications**.

**Chest X-rays** may confirm *effusions*, *collapse* and *consolidation*, *active infection*, *pulmonary oedema*, or the *hyperinflated lung fields of emphysema*.

**An electrocardiogram** may indicate *P-pulmonale*, a right ventricular strain pattern (dominant R waves in the septal leads) or *right bundle branch block*.

**Pre-medication** In patients with **poor respiratory function** **premedication** (if used) must **not cause respiratory depression**. **Opiates** and **benzodiazepines** can both **do this**, and are **best avoided if possible**, or **used with caution**.

**Humidified oxygen** may be administered (see Oxygen therapy section). **Anticholinergic drugs** (e.g. atropine) may **dry airway secretions** and **may be helpful** before ketamine or ether.

**Specific Respiratory Problems** **Coryza** (common cold) (i) Most patients with minor upper respiratory infections but without *fewer or productive cough* can **have elective surgery**( not postponed ). (ii)However, **patients with underlying respiratory disease** or those having **major abdominal** or **thoracic surgery** should be **postponed**.

**Respiratory tract infections** Patients with *fever* and *productive cough* **should be treated before undergoing elective surgery as there is an increased risk** of **postoperative pulmonary complications**.

When these patients present **for emergency surgery a course of antibiotics should be administered**.

## **Asthma**

Asthma causes *hyper-responsive airways* with *oedema*, *inflammation* and *narrowing* due to smooth muscle spasm.

It is characteristically **reversible**, unlike chronic obstructive pulmonary disease. (i) **Elective cases** should not be undertaken **unless asthma is well controlled**, and the anaesthetist will need to be informed of *poorly controlled* and *severe asthmatics* in advance. **A consultation with a respiratory physician** may be useful. (ii) **In poorly controlled asthma** a **short course of steroids** is **often effective** in improving control of the disease. **Patients on preoperative steroids will need extra perioperative supplementation** if they are taking more than the equivalent of 10mg of prednisolone a day

## **Preoperative assessment**

- 1) ● The disease is **assessed** by the *frequency and severity of attacks*, including hospital and intensive care admissions, and *by drug history*. The patient will be able to say how good (or bad) their asthma is.

**Examination** may reveal expiratory wheezes, use of accessory muscles or an over-distended chest. **Peak expiratory flow rates (PEFR) pre- and post-bronchodilator should be measured**, although trends in PEFR are more useful (the patient may have their own PEFR records). **Baseline spirometry, (FEV1.0 and FEV1.0:FVC ratio) is also helpful.**

- 2) • **Blood gas analysis** is usually reserved for severe disease (breathlessness on minimal exertion).
- 3) • **Before surgery**, patients **should be free of wheeze**, with **a PEFR greater than 80%** of the predicted or personal best value. **Severe asthmatics** may require their inhalers being changed to nebulisers. Similarly inhaled steroid dose may have to be increased or oral steroids commenced (Prednisolone 20-40mg daily) one week prior to surgery - consult a respiratory physician early. Perioperative management
- 4) • **Consider converting inhaled beta 2 agonists** such as salbutamol to the nebulised form. Give nebulised salbutamol (2.5-5.0mg) with premedication.
- 5) • **Avoid aspirin or NSAIDs** and any other allergens known to the patient. If applicable local or regional anaesthesia used alone will avoid the problems of general anaesthesia. However, if general anaesthesia is required, the addition of regional techniques can reduce operative volatile anaesthetic and post operative opioid requirements and the likelihood of respiratory complications.
- 6) • **Ketamine and all the volatile agents** are bronchodilators. Airway manipulation should be kept to a minimum and take place only under adequate anaesthesia.
- 7) • **Controlled ventilation** with the use of neuromuscular blocking drugs will be needed for major or long procedures. In cases with severe airways obstruction the ventilator rate may have to be sufficiently low to allow the slow expiration of asthma. Atracurium and tubocurarine should be avoided as they release histamine. This is also true of morphine - pethidine is often preferred in patients who are wheezy on presentation.
- 8) • **Residual neuromuscular blockade** must be fully reversed, and extubation can occur when 54 Update in Anaesthesia spontaneous ventilation is resumed and oxygenation is adequate.

## Postoperative care

- Adequate analgesia is vital.
- Humidified oxygen is continued for up to 72 hours following major abdominal or thoracic surgery (see Oxygen therapy section), together with regular physiotherapy until the patient regains mobility.
- Maintenance of hydration with intravenous fluids is required until oral intake is sufficient.
- Usual anti-asthmatic medications are resumed immediately. This may require intravenous steroids to temporarily replace oral (see Steroid supplementation section) and nebulised bronchodilators to replace inhalers if the patient cannot take a deep breath, or pulmonary function has deteriorated after surgery.
- Failure to ensure adequate postoperative oxygenation and ventilation may require admission to an intensive care area for a period of assisted ventilation.

## Chronic obstructive pulmonary disease (COPD)

The main problems are airflow obstruction (usually irreversible), mucus hypersecretion and repeated infections.

**The ASA grade** correlates with the risk of postoperative pulmonary problems. If reversibility is demonstrated by spirometry (i.e. an increase in FEV1.0:FVC ratio after bronchodilator), it is treated as for asthma. A trial of a week's course of systemic steroids (Prednisolone 20-40mg daily) is used if nebulisers fail to treat wheeze. Antibiotics are only used if a change in sputum colour suggests active infection.

Right and left ventricular failure is treated with diuretics. Physiotherapy will clear chest secretions and the patient is encouraged to stop smoking. Preoperative arterial blood gas estimation is required in the patient who has difficulty climbing one flight of stairs, or who has cor pulmonale. Postoperatively, these patients may need ventilating for 1-2 days on an intensive care unit following thoracic or high abdominal surgery.

The best predictor of the need for postoperative ventilation is the arterial PaO<sub>2</sub>, and whether the patient is dyspnoeic at rest.

Otherwise, perioperative considerations are the same as for asthma, except that the chances of post-operative pneumonia (pyrexia, purulent sputum) are high and will require early treatment with amoxycillin, trimethoprim or clarithromycin. Postoperatively, care is required with oxygen supplementation as some COPD patients rely on relative hypoxia for respiratory drive. (see Oxygen therapy section). Restrictive pulmonary disease Restrictive disease is either intrinsic, such as pulmonary fibrosis related to rheumatoid arthritis or asbestosis, or extrinsic, such as caused by kyphoscoliosis or obesity. Oxygenation may be impaired at the alveolar level and because of poor air supply to it. Steroids are the usual treatment for fibrotic disease.

## Intrinsic Disease

- The anaesthetist should be alerted early. Preoperatively obtain spirometry, arterial blood gases, lung volume and gas transfer measurements, if not done in the previous 8 weeks. A reduced PaO<sub>2</sub> indicates severe disease. The chest physician may suggest an increase in steroid dose.
- Steroid supplementation will be required over the operative period (see Steroid supplementation section).
- Postoperatively, supplemental oxygen is given to keep SpO<sub>2</sub>>92%, and respiratory infection is treated early.

## Extrinsic Disease

- The restrictive deficit here leads to rapid, shallow breathing, often relying on diaphragmatic movement to be effective. This poses problems for breathing and sputum clearance postoperatively, especially following thoracic or upper abdominal incisions.
- Blood gases remain normal until disease is severe and PaCO<sub>2</sub> rises.
- Postoperatively, vigorous physiotherapy and adequate analgesia are vital. The patient may require ICU or HDU care if postoperative hypoxia, fatigue or carbon dioxide narcosis occur. Bronchiectasis and Cystic Fibrosis Prior to surgery therapy is maximised using a course of intravenous antibiotics, physiotherapy, nebulised bronchodilators and an extra 5-10mg/day of oral prednisolone, if taking long term steroids. This involves discussion with the patient's chest physician.

Elective surgery is postponed if respiratory symptoms are present. Update in Anaesthesia 55 Postoperatively continue intravenous antibiotics and regular physiotherapy until discharge. The chest physician should be involved in any respiratory problems, and adequate nutrition is resumed as early as possible.

## Tuberculosis

The patient with **active pulmonary tuberculosis** may be wasted, febrile and dehydrated. Production of sputum and haemoptysis may cause **\*segmental lung collapse** and **\*blockage of the endotracheal tube**. **Humidification** of "anaesthetic breathing systems" is therefore **important**, and inspired oxygen concentration will have to be increased. Appropriate intravenous fluids are given **to rehydrate the patient**. Anaesthetic equipment must be sterilised after use to prevent cross infection of tuberculosis to other patient

## Anaesthesia – Techniques

Perioperatively, continuous clinical observation of the patient is combined with monitoring appropriate to the case being undertaken. Hence, the patient's color and respiratory rate and pattern is **observed**, and the pulse volume and rate palpated (during anaesthesia it may be easier to **palpate the facial, superficial temporal or carotid artery**).

Monitoring involves pulse oximetry, electrocardiogram, non-invasive blood pressure recordings and, if available, end-tidal carbon dioxide measurement. A preoperative pulse oximeter measurement of peripheral oxygen saturation in air is useful, and the perioperative inspired oxygen concentration must be sufficient to maintain this. Those patients at **greatest risk of perioperative pulmonary complications** will benefit from regular blood gas analysis using an indwelling arterial catheter. The technique of anaesthesia chosen is the one considered to carry the lowest risk of perioperative pulmonary complications. **The following points should be considered:**

- Regional anaesthesia will **avoid** the pulmonary complications of general anaesthesia, but its use is limited by the duration of local anaesthetic activity, and to certain areas of the body, i.e. face, eyes and limbs.
- Spinal/Epidural anaesthesia. High spinal and epidural techniques **impair intercostal muscle function** and result in a decrease in FRC and an increased risk of **perioperative basal atelectasis and hypoxia**. There is no clear evidence that these techniques result in fewer respiratory complications than after general anaesthesia, although avoiding tracheal intubation may **decrease** the risk of postoperative bronchospasm.
- Low spinal and epidural techniques **can be used** for surgery below the umbilicus and on lower limbs **without pulmonary impairment**. However, under general anaesthesia, this kind of surgery has a low risk of pulmonary complications. As such there is little to choose between these two techniques. When planning to use spinal or epidural anaesthesia ensure that the patient will be able to lie flat for an extended period.

- **Ketamine** anaesthesia **maintains** some of the airway and cough reflex. Ventilation is not depressed, but there is an increase in salivation such that **atropine** premedication is required. Without muscular relaxation and endotracheal intubation, the airway remains vulnerable to **aspiration** of vomited or **regurgitated** gastric contents. Ketamine as the sole anaesthetic agent is therefore not used in the patient with a full stomach, and is most commonly used for surgery of the face, limbs or perineum, where muscular relaxation is not required.
- **Controlled ventilation.** Endotracheal intubation using muscle relaxants and controlled ventilation will be necessary during head, neck and ear, nose and throat surgery. Here the airway must be secured at the beginning of surgery as access to it will be difficult when surgery has commenced. Also, the trachea is at risk of soiling from blood. Similarly, during thoracic or abdominal surgery muscle relaxation will be required to enable controlled ventilation, and endotracheal intubation will protect against tracheal aspiration of gut contents. When patients require surgery in the **prone position** airway access will be difficult, and endotracheal intubation and controlled ventilation will be required.
- **Spontaneous ventilation** employing a facemask avoids airway instrumentation, although leaves the airway unprotected. If available, the laryngeal mask does not stimulate the larynx, but does offer some protection for the trachea. This technique is only used for minor surgery of the limbs or body surface of short duration (less than 2 hours), when the patient can breath comfortably in the supine position or on their side. Prolongation of spontaneous ventilation anaesthesia may lead to **respiratory depression** and **delayed recovery**.